Interoperability:

It's time for action!

or

Do we want to solve it, or just bitch about it?

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Presentation Objective

- To induce discussion and <u>action</u> which leads to solving the problem of interoperability for heterogeneous networked simulation systems.

- Why? Because clearly we do not have agreement on a course of action for working on interoperability, otherwise we would be "doing" instead of meeting/ discussing!

  Workshop Purpose: Develop a baseline understanding of the current state of the practice in technical approaches applicable to the description, generation, and management of simulation and federation environments involving multi-resolution interaction.

  Workshop Focus: Technical discussion of current implementations of multi-resolution environments as a base for initiating future technical direction and investments.

Some Definitions
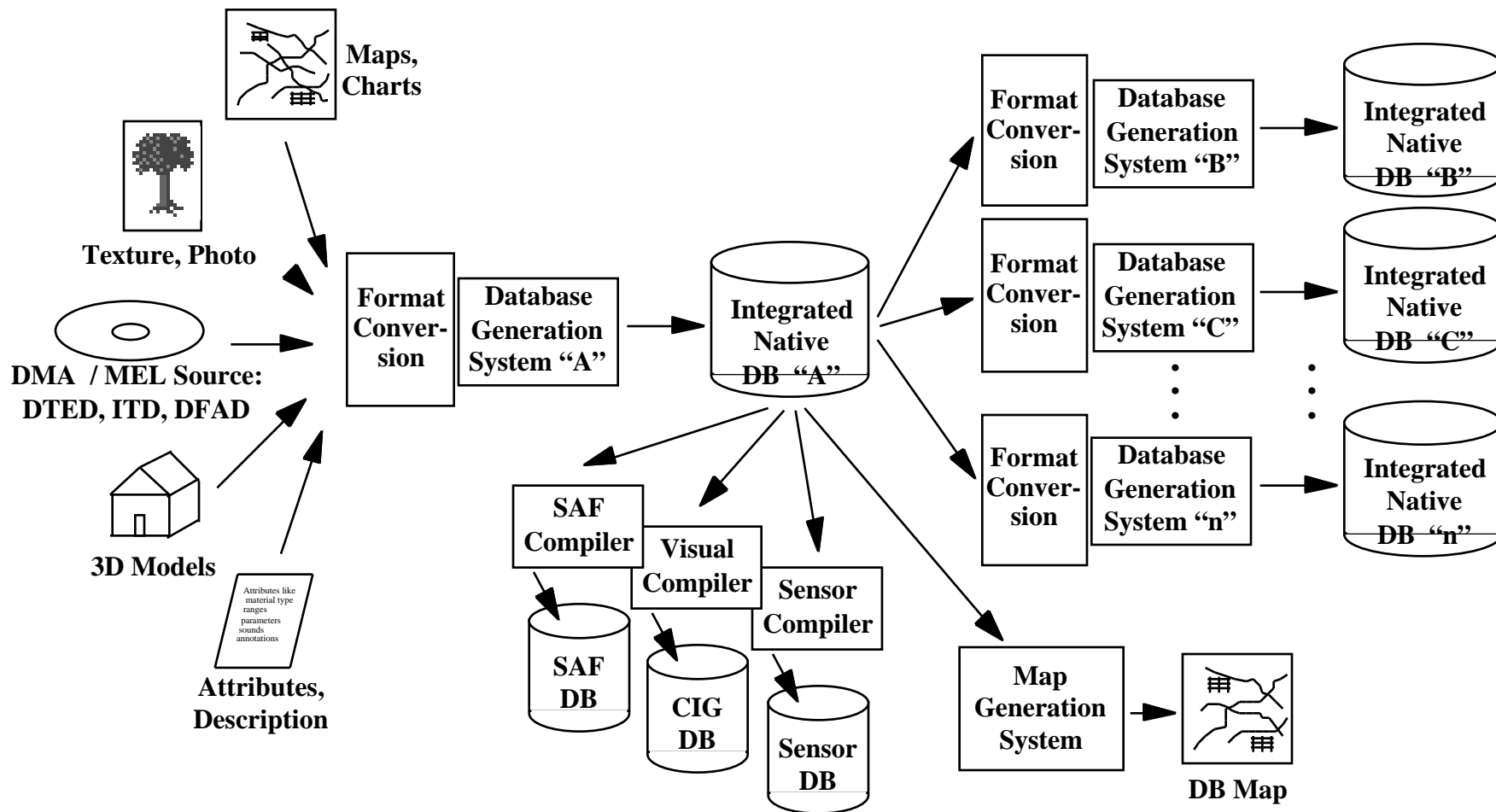
- What is a multi-resolution environment?

  At least two perspectives:

  (1) Multi-resolution source (raw) data used to build the initial environment database,

  (2) An integrated environment database "adapted" for use in each level of a multi-resolution simulation system to achieve interoperability.

- The first one is very important and is a major topic onto itself, but it is not the core cause of interoperability.

- Achieveing the second one is the the challenge. It is also more than what is IN the environment.

How M&S Databases Are Generated and Shared Today

Maps, Charts

Texture, Photo

DMA / MEL Source: DTED, ITD, DFAD

3D Models

Attributes like material type ranges parameters sounds annotations

Attributes, Description

Format Conversion → Database Generation System "A" → Integrated Native DB "A"

Format Conversion → Database Generation System "B" → Integrated Native DB "B"

Format Conversion → Database Generation System "C" → Integrated Native DB "C"

Format Conversion → Database Generation System "n" → Integrated Native DB "n"

SAF Compiler → SAF DB

Visual Compiler → CIG DB

Sensor Compiler → Sensor DB

Map Generation System → DB Map

Some Definitions (cont.)

- What constitutes interoperability?

  Interoperability is achieved if the <u>perception</u> of the same events is similar and consistent when the events are viewed/ experienced from different simulators. This is MORE than having multi-resolution environments.

- Resolution of perception, and not necessarily data resolution, is key.

- Interoperability is, at least partially, a subjective matter!

- Interoperability issues are not fully understood, but interchange methods, both content & implementation, have a significant effect on interoperability.

Some Definitions (cont.)

- How is interchange of data related to interoperability?

  The interchange process is the necessary step that enables us to address interoperability issues. A consistent, efficient, and unambiguous initial condition is the measure of good interchange and the pre-condition for achieving interoperability.

- Data interchange is done in one of two methods:

  - dynamic interchange (PDU's, dynamic environment/terrain)

  - static interchange (databases, geometry, set parameters)

  Implementation of interchange mechanism and associated problems must be addressed first

  (we are doing this: SEDRIS and HLA/RTI)

Some Definitions (cont.)

- Interchange of data, however, does NOT mean nor guarantee interoperability.

- But having a robust and unambiguous interchange mechanism is a necessary pre-condition to interoperability.

- If the pre-condition is not there, then, at best, we usually "<u>hurt</u>" A LOT before being able to start with the same baseline environment!

Interest

- Why do we want Multi-Resolution Environments?

  To interoperate.

- Why do we want to interoperate?

  $$ To leverage on existing investments $$

  Otherwise, given enough "resources" we can build a set of simulation systems that "fits all" and will be guaranteed to interoperate!

- We can't discuss multi-resolution environments in a networked (heterogeneous) simulation without discussing and addressing interoperability.

Why Can't Birkel's Questions Be Answered Easily?

- Because interoperability is a multi-dimensional space where the axes and the range and value for each axis are not well known. At the same time they are inter-dependent on each other (even if they are well known)!

- Therefore the rules that govern this space and the trade-offs that can be allowed within the space are, for the most part, unknown.

Rules of Interoperability

- Good news: We know the rules for NOT being interoperable!

- More good news: We can derive the <u>specific</u> rules of interoperability (**SIMNET, CCTT, STOW, I/ITSEC, etc.**)

- Bad news: No knowledge of <u>general</u> rules of interoperability.

- Understanding generalized interoperability requires the discovery and understanding of these rules!

- One way of discovering the rules is to explore the space by conducting experiments and map them out.

Rules of Interoperability (cont.)

- To address interoperability, the rules associated with each cell of a matrix similar to the following must be filled.

- Different applications require different rules!

		Live				Virtual				Constructive			
		Gnd	Air	Sea	N. Gnd	Gnd	Air	Sea	N. Gnd	Gnd	Air	Sea	N. Gnd
Live	Ground												
	Air												
	Sea												
	Near Gnd												
Virtual	Ground												
	Air												
	Sea												
	Near Gnd												
Constructive	Ground												
	Air												
	Sea												
	Near Gnd												

Examples of Experiments

- Side by side SAF (CCTT and ModSAF)
- Abstraction/aggregation vs. "full resolution"
- Boundary conditions across aggregation/resolution levels
- Effects of geometry, surfaces
- Effects of feature and feature placement
- Effects of texture, color, and sensor attributes
- and many more ...

How Do We Solve Interoperability?

- Agree that our collective goal is interoperability of simulations and not just "machines" on the net.

- Identify and designate one organization as the lead.

- Plan a strategy for solving the pieces of the interoperability puzzle.

- Fund the plan!

- Execute the plan by conducting small, controlled, scientific experiments that map out the general rules of interoperability.

- Invest in tools! To facilitate experiments and to measure the results.

Tools, tools, tools

- Tools to measure:

  context-based database differences (as opposed to blind measure of differences)

  coordinate conversion compliance

  network interface

  many more ...

- Analytical metrics to measure "success"
- Smart Stealths
- Every dollar invested in tools will pay for itself ten-fold in the life of the program!